REMARKS

The claims have been amended in order to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention and respond to the Examiner's rejections under 35 USC 112. Additionally, the subject matter of Claims 13 and 14 have been incorporated into Claims 11 and 12 respectively. As such, Claims 13 and 14 have been canceled. No new matter has been added.

Claims 2-5 and 11-16 have been rejected under the judicially created doctrine of obviousness-type double patenting over Claims 1-8 of U.S. Patent No. 6 086 766 in view of Smith et al. Claims 2, 5, 11 and 13 have been rejected under 35 USC 103(a) as being unpatentable over Smith et al in view of JP 36-0118299A. Claims 3 and 4 have been rejected under 35 USC 103(a) as being unpatentable over Smith et al in view of JP 36-0118299A and further in view of JP 40-4225900A. Claims 12 and 14 have been rejected under 35 USC 103(a) as being unpatentable over Smith et al in view of JP 36-0118299A and further in view of Dorau et al. Claim 15 has been rejected under 35 USC 103(a) as being unpatentable over Smith et al in view of JP 36-0118299A and further in view of Lowther. Applicants respectfully traverse these grounds of rejection and urge that the currently presented claims are clearly patentably distinguishable over the prior art cited by the Examiner.

The presently claimed invention is directed to a process for aerobic biological treatment of an aqueous organic waste which comprises the steps of introducing the aqueous organic waste into an aeration tank, aerating the aqueous organic waste in the aeration tank in the presence of a biosludge comprising aerobic microorganisms to form an aerated aqueous suspension, withdrawing aerated aqueous suspension from the aeration tank and introducing the withdrawn aerated aqueous suspension into a solid/liquid separation unit, subjecting the aerated aqueous suspension in the solid/liquid separation unit to solid/liquid separation to form a separated sludge containing the biosludge and separated liquid phase,

withdrawing the separated liquid phase from the process as treated water, recycling at least a portion of the separated sludge back to the aeration tank, ozonizing either aerated aqueous suspension withdrawn from the aeration tank or a part of the separated sludge to ozonize and convert biosludge contained therein into BOD components, the ozonizing taking place at a pH of 5 or lower, and recycling either the ozonized aerated aqueous suspension or the ozonized part of the separated sludge back to the aeration tank for aerobic biological treatment, wherein the amount of biosludge ozonized and converted into BOD components is greater than the amount of generated excess sludge.

Another embodiment of the present invention is also directed to a process for aerobic biological treatment of an aqueous organic waste which comprises the steps of introducing the aqueous organic waste into an aeration tank, aerating the aqueous organic waste in the aeration tank in the presence of a biosludge comprising aerobic microorganisms to form an aerated aqueous suspension, withdrawing aerated aqueous suspension from the aeration tank and introducing the withdrawn aerated aqueous suspension into a membrane separation unit, subjecting the aerated aqueous suspension in the membrane separation unit to membrane separation to form a permeated liquid and a concentrated sludge containing the biosludge, withdrawing the permeated liquid from the process as treated water, recycling at least a portion of the concentrated sludge back to the aeration tank, ozonizing either aerated aqueous suspension withdrawn from the aeration tank or a part of the concentrated sludge to ozonize and convert biosludge contained therein into BOD components, the ozonizing taking place at a pH of 5 or lower, and recycling either the ozonized aerated aqueous suspension or the ozonized part of the concentrated sludge back to the aeration tank for aerobic biological treatment, wherein the amount of biosludge ozonized and converted into BOD components is greater than the amount of generated excess sludge.

As discussed previously, the inventive feature of the present invention resides in the ability of it to reduce the

amount of excess sludge generated during an aerobic biological treatment process by using ozone to oxidatively reduce waste materials containing biosludge and the recycling of the oxidized waste materials back into an aerator. The presently claimed invention requires that either a part of the separated sludge or aerated aqueous suspension withdrawn from the aeration tank be subjected to an ozone treatment at a pH of 5 or lower, the ozonized aerated aqueous suspension or ozonized part of the separated sludge be recycled back to the aeration tank for further aerobic biological treatment and the amount of sludge ozonized and converted into BOD components be greater than the amount of generated excess sludge.

In the present invention, an excess amount of biosludge in the aerobic biological treatment system is extracted therefrom and subjected to an ozone treatment under an acidic condition of a pH of 5 or lower. It is preferable that a part of the sludge to be recycled to the aeration tank, extracted from the recycling line, be subjected to ozone treatment together with the excess sludge. Through this procedure, the amount of excess sludge which has to be removed and disposed of can be reduced to the point of complete elimination.

By the aerobic biological treatment of the ozonized sludge suspension, organic matter contained in the suspension is removed easily by biodegradation so that the amount of excess sludge to be exhausted from the entire system is decreased. The larger the amount of sludge to be ozonized, the higher the rate of reduction of the sludge amount will be. While the amount of excess sludge is not able to be reduced to zero due to the increase in biosludge upon the biodegradation of organic matter in the ozonized biosludge, the overall amount of excess sludge formed in the entire system can be made to be zero so that the superfluous amount of biosludge extracted from the aeration tank so as to make the apparent increase in the amount of biosludge should be zero. In this instance, the biological treatment performance of the system may be sometimes decreased by increasing the amount of biosludge to be treated. In this type of situation, the biological treatment performance can be maintained at a high

level by incorporating support bodies in the aeration tank for supporting the biosludge thereon so as to keep a definite amount of the biosludge in the tank. The amount of consumption of ozone is decreased by the present invention by effecting the ozone treatment of excess sludge at a pH of 5 or lower to an amount of about 1/2 to 1/3 of the amount of ozone consumed without pH control. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

U.S. Patent No. 6 086 766 to Yasui discloses a process for reducing the amount of excess sludge by aerobically treating an aqueous organic waste in an aeration tank in the presence of a biosludge containing aerobic microorganisms, subjecting the resulting mixed liquor to a solid/liquid separation, the so-separated liquid phase being discharged as treated liquor, and supplying at least a part of the separated biosludge, after having been treated with ozone, to the aeration tank.

The ozone treatment is realized by passing a mixed flow of biosludge-containing liquor to be treated or a liquor containing the ozonized biosludge and of an ozone-containing gas through a flow-down pipe in a downward flow and introducing the flow into an ozone-treating vessel in a state in which the ozone-containing gas is dispersed as finally disintegrated bubbles, whereby the clogging of a gas diffuser due to the adhesion of the biosludge is avoided and ozone treatment is attained at a high ozone yield.

However, this reference has no disclosure with respect to the amount of biosludge being ozonized and converted into BOD components being greater than the amount of generated excess sludge. As discussed above, this can result in the overall amount of excess sludge formed in the entire system to be reduced to zero. This is clearly an unobvious distinction over the claims of Yasui et al so the secondary Smith et al reference must provide the motivation to one of ordinary skill in the art to operate the process of Yasui et al in that manner in order for a proper obviousness-type double patenting

rejection to be made. It is respectfully submitted that the secondary reference contains no such disclosure.

The Smith et al reference discloses a method for the treatment of sewage or other biodegradable waste materials which comprises an aerobic process in which a settleable sludge is formed and a selected portion of the returned sludge is subjected to a microbial biolysis process. Smith et al further discloses that the microbial biolysis can be performed by electrolysis, ultrasonics, heat, low temperature, photochemistry, ozonization and other means. However, this reference has no disclosure with respect to operating the method disclosed there such that the amount of biosludge ozonized and converted into BOD components is greater than the amount of excess sludge generated. As such, Smith et al in combination with Yasui et al do not present a disclosure which would support an obvious-type double patenting rejection.

JP 36-0118299A discloses a method for modifying and dehydrating organic sludge in which the pH of sludge supplied from a sludge tank is adjusted to from 3-6 and then mixed and contacted with an ozone-containing gas to perform modification thereof. The modified sludge is dehydrated and discharged as a dehydrated cake. However, like the previously discussed references, this reference has no disclosure with respect to performing a process for biological treatment of aqueous organic waste using an ozonization step in which the amount of biosludge ozonized and converted into BOD components is greater than the amount of excess sludge generated. Therefore, it is respectfully submitted that the presently claimed invention is patentably distinguishable over Smith et al in combination with JP 36-0118299A.

JP 40-4225900A discloses a method for anaerobically digesting organic sludge in which an organic sludge is heated in a sludge heating tank, introduced into a flotation concentration tank and then introduced into an anaerobic digestion tank. However, this reference does not cure the deficiencies of the previously discussed references in that it does not disclose the performing of an ozonization step in which the amount of biosludge ozonized and converted into BOD

components is greater than the amount of excess sludge generated or suggest anything regarding the benefits achieved by such an operation. As such, it is respectfully submitted that the presently claimed invention is patentably distinguishable over this reference in combination with any of the previously discussed references.

The Dorau et al reference discloses a method and apparatus for biologically purifying sewage which is organically loaded with substances which are difficult to decompose biologically or not decomposable biologically. This reference further discloses the use of membrane-filtering or nano-filtering to remove substances that are difficult to decompose biologically or not biologically decomposable. However, this reference does not cure the deficiencies of the previously discussed references in that it does not suggest operating a process for biological treatment of aqueous organic waste utilizing an ozonization step in which the amount of biosludge ozonized and converted into BOD components is greater than the amount of excess sludge generated. As such, the presently claimed invention is patentably distinguishable over this reference in combination with any of the previously discussed references.

The Lowther reference discloses a process for the intermediate treatment of aqueous sewage containing biodegradable materials and non-biodegradable materials. The sewage is contacted with an organic-containing gas to pretreat the sewage by converting a substantial amount of the non-biodegradable material to biodegradable material, followed by a conventional secondary treatment with an oxygen-containing gas such as air in the presence of aerobic or facultative anaerobic microorganisms. This process may also include subsequent tertiary treatment with ozone to destroy the microorganisms after secondary treatment. However, this reference does not disclose the performing of an ozonization step under such conditions that the amount of biosludge ozonized and converted into BOD components is greater than the amount of generated excess sludge. Therefore, Applicants respectfully submit that the currently claimed invention is

patentably distinguishable over this reference in combination with any of the previously discussed references.

None of the references cited by the Examiner disclose performing an ozonization step in which the amount of biosludge ozonized and converted into BOD components is greater than the amount of generated excess sludge. As stated previously, in the present invention, the amount of excess sludge which has to be removed and disposed of can be eliminated by ozonizing and converting to BOD components an amount of biosludge which is greater than the amount of excess sludge generated. None of the references cited by the Examiner disclose this feature and, as such, it is respectfully submitted that the presently claimed invention is clearly patentably distinguishable over the prior art cited by the Examiner.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,

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